

**DOCKET**

**11-ALT-1**

DATE JAN 05 2012

RECD. JAN 10 2012

California Energy Commission  
Re: Docket No. 11-ALT-1,  
"2012- 2013 Investment Plan."

California has always been an innovator, leading the way with new innovations that other states and even countries have tracked. California under its Alternative and Renewable Fuel and Vehicle Technology Program serves as the nations guidance for the allocation of program funds committed to reduce greenhouse gas emissions, reduce petroleum use, improve air quality, and stimulate the sustainable production and use of alternative fuels within the State. Alternative and renewable transportation fuels must have a developed infrastructure to dispense these gasoline substitutes and California is again at the forefront in providing State funds to help fill the gap and to offset the differential cost of these emerging fuels and vehicles.

This plan is also the vision of one company named HyGen, who for the last 20 years has been an alternative fuel integrator and has represented many partners active in moving the "Hydrogen Highway" forward. With this passion, HyGen will be an active player in submitting proposals for new hydrogen station locations throughout the State once the new 2012 CEC Hydrogen Fuel Station Infrastructure solicitation is released. HyGen understands the importance of having a well trained workforce, one that can adapt to a changing future and the investment plan provisions under the "Establish workforce training programs" is a means to help educate the public and create technology centers. Workforce training and development are critical components in the States effort to develop a clean transportation economy.

However, one significant workforce that the 2011- 2012 investment plan has overlooked is the training and education of engineers, technologists, and technicians who are currently in school or looking for a career change to improve their skills sets. This workforce segment is vital in order to develop our economic and sustainable design model and to help solve our future fueling problems. This ignored group is the reason HyGen is petitioning the CEC review committee to consider allocating funds to include universities under the 2012-2013 Investment Plan, giving universities the same opportunities available under the current workforce training categories. HyGen has done extensive research and examined the implications as to the training and education of future engineers, technologists and technicians to meet the expected changes concerning the domestic engineering and technology workforce. The information gathered see a void in the preparation of the next engineering workforce, one that needs to focus on the expected surge of fuel cell electric vehicles (FCEVs) and hydrogen fueling infrastructure.

HyGen's program has resulted from collaboration with industry and student demand, and is built on a core of specialized courses that will enable a graduate to be immediately industry ready to design, construct, select equipment and maintain and operate these future hydrogen fueling stations and alternative fuel vehicles. By providing different job opportunities within this technical field, this will help make available career paths with a high level of mobility that can range from: skills that are mobile vertically, horizontally and across industries. It is therefore, HyGen's plan to improve career prospects after they have completed their technical education training.

The training program HyGen is proposing is prioritized to focus on the target audiences involved in facilitating the use of hydrogen and fuel cell technologies for near-term applications as well as for longer-term light-duty transportation applications. To gain support for this type of program, outreach to state and local government officials is essential, and to initiate a range of hydrogen and fuel cell educational/training program opportunities for university students with the objectives of both general and specific training. There is an acknowledged need for educated trainers, engineers, technologist and scientists to work in hydrogen and fuel cell technology areas. This gap must be filled to advance hydrogen and fuel cell education/training programs to assist in the ongoing efforts to educate/train not only the next workforce, but first responders, code officials, teachers and students at all levels across the education portfolio.

Technology and Engineering Education is committed to preparing students for employment and/or continuing education opportunities by teaching them to understand, design, produce, use, and manage the human-made world in order to contribute and function in a technological society. Three factors are essential for this to succeed:

1. What level of education do you need for this job?
2. What technical capabilities or other skills does the employer desire - or require?
3. How much prior experience, if any, does the employer expect you to have?

The field of engineering/technology continues to reinvent itself. The variety of engineering and technology specialties not only design bridges, automobiles, buildings, but, create complex computer programs, and sustainable and efficient urban infrastructure. Also, due to the expansion of jobs in the technical fields and the increasing number of engineers who are retiring, the number of job openings in technology and engineering continues to increase, but the job requirements are changing to meet these new technology challenges.

HyGen's program is simple with the focus of providing an invaluable combination of education and direct hands-on experience through real world commercial deployments with selected equipment suppliers from a range of industries. Using this market sector, as well as selecting the proper universities is a key component for commercial growth and ideal for targeted outreach. The location of the hydrogen station project sites and our university relationships are well-chosen in the effort to reach the broadest audience possible. With this idea as the building point, HyGen has reviewed the broad target audience and has put together a seven step training program (listed below) to ensure the future success of hydrogen and fuel cells.

#### HyGen's Seven Step Program

##### 1. Project Goals:

Like the goal of the Investment Plan, HyGen is also concern that we need a well trained workforce to realign our States future labor force to respond to this new technology challenge. With this goal in mind and in the interest of working with California's education system, HyGen has made contact with three California State Universities which are listed below.

- California State University, Los Angeles (CSULA)

- California State University, Sacramento (CSUS) and,
- California Polytechnic State University, San Luis Obispo (CPSLO).

HyGen has asked each university to incorporate topics to train students about the applications of how to design, construct, select the equipment, install equipment, and operate and maintain a hydrogen fueling station and fuel cells. The individuals that complete this program could be the next workforce development trainer, or a teacher at a community college or at the K-12 level or designer of the next energy efficient station. This knowledge transfer will assist in the development of California's professional community, a needed economic development lever to advance California's clean transportation industry.

HyGen's workforce training plan is to work with each university in preparing students to be hired by HyGen as interns once the stations are in operation or during the late stage of construction. However, the training process does not start once the station is commissioned, but will begin during the 2012 academic year when funding is approved or when the 18-24 month design/build phase begins after funds are released, maybe Spring/Summer of 2012. It is estimated that it will take one academic year to have qualified students ready to assume the task in the design and operation and maintenance phase. This phase will require monitoring closely of the hydrogen generating and dispensing equipment, making sure that the customer has no problems during fueling.

Because of budgetary constraints each university will incorporate topics related to hydrogen and the fueling infrastructure to fit existing classes to reduce cost and time. To help the other two universities in the curriculum development, CSULA will provide curriculum help by virtue of having operating hydrogen station as a field lab on campus. Exchange of information might take the shape of: webinars, workshops, prepared presentation slides that can be shared by each university, and field trips, if necessary.

## **2. Workforce Training Concept:**

HyGen's plan is to establish the state and nation's first workforce/education training program devoted to the emergence of the hydrogen infrastructure, by supporting each university with technical information, as well as helping with finding financial aid grants, and as the direct link with all of the equipment suppliers HyGen currently is working with. In this effort, HyGen will require each equipment supplier to engage in helping develop the course curriculum with the professors from each university. Adapting this new training approach will help demonstrate that there is interest at the higher academic level, showing a clear indication that students and faculty are eager to embrace a new education paradigm. This new workforce training element will bridge between the engineering/technology educational community, and major stakeholders in transforming how students learn and the value this type of curriculum will have in the formation of the Hydrogen Highway. It is estimated that each university during the academic calendar year will train from 15 to 20 students if one class is offered or as many as 60 students if multiple classes include topics related to hydrogen/fuel cells and it's applications.

## **3. Preliminary Course Offering:**

Each professor will develop and adapt their own curriculum to fit the educational/training requirements of the respected university. However, to assist in the formation of the initial course material, collaboration with CSULA is the fundamental process in meeting the requirements of HyGen's goal. HyGen has asked each professor to include topics focused on hydrogen and fuel cells as the basic requirements; however, this is not mandatory and variation will be adapted by each professor to meet the changing needs of the educational environment in which each needs to operate. A list of possible class topics are listed below and classes that are possible candidates at each university in adding hydrogen and fuel cell topics are listed under Education Curriculum Development section on page 5 of this report.

- Cascade storage system
- Hydrogen economy
- Hydrogen fuel cell vehicles
- Hydrogen production
- Hydrogen storage
- Hydrogen reformer
- Hydrogen piping system
- Hydrogen leak testing
- Hydrogen sensors
- Hydrogen sensor
- Autonomous building controls
- Micro-generation
- Virtual power plant

#### 4. Project Strategy:

HyGen's plan is to hire intern students who will monitor the operation of the fueling station(s) using different IT infrastructures (which HyGen will set-up). The three universities selected are positioned to support the 15+ fueling stations, and 1 feeder station HyGen is looking to install. In addition to the monitoring aspect, each intern student will also be asked to perform minor maintenance to insure that the station is in full operation without any complications and to interface with the station user if the user is having problems with the station equipment. Students will also be asked to make adjustment(s) to the equipment to correct any minor problems that they can solve over the Internet, as this will be a web-base connection. If the student is not able to correct the problem, they will be asked to inform the equipment vendor and request service, plus notify the California Fuel Cell Partnership "Station Operational Status System" (SOSS) indicating that the station is out of service. Once the SOSS is contacted, SOSS will automatically update the station status using GPS positioning and this information will be available either by Smart Phone with GPS or web base connection. SOSS will also inform the user of the expected station down time (if known) or direct them to the closest hydrogen station to their current location.

HyGen believes in cooperative education and workforce training primarily involving sequential education and training, in both theory and in applied/practice application. All three universities have the same goal of fitting education/training to meet the students and community needs; however, each university also has to comply with its own

education mission as set forth by its governing body. As stated, the key component is the development of the educational/training curriculum that will focus on the design, construction, equipment selection, maintenance and operation of the proposed station(s).

#### **5. Program Implementation:**

To accomplish these goals, HyGen will work closely with all three universities to implement practical and cost effective "Hydrogen and Fuel Cell" programs, and will enlist the cooperation of the equipment vendors in providing industry training requirements, helping the universities to meet the future workforce demands within this new field. Beside the technical aspect of the curriculum program, CSULA Industrial Technology Programs are comprised of two major options; one that concentrates on a career in industry and the other which focuses on the teaching of Industrial Technology at the K-12 or at a community college level. Students who select the teaching option will aid in building the foundation needed at this stage to expand the learning curve about hydrogen and it's practical applications, helping this new generation of potential engineers and technologists be prepared for this new challenge.

#### **6. Training Time Line:**

HyGen envisions a program that will last beyond the contractual requirement of the solicitation, but will begin to implement the training component as stated under "Project Goals" during the 2012 academic year and will work with the universities to have intern students ready once the stations come online or during the design/build period or the late stage of construction. If the program is successful after three years, HyGen is considering expanding the education/training segment to include community college students trained as service technicians and the retraining of engineers and technologists interested in working in this field. It's also anticipated that students will be part of outreach programs to help parents and the community learn more about alternative energy and ways hydrogen can play an important role in improving our economy and the social benefit using this clean fuel source. Greater support will be needed and community interface is one way to get this support, and to spread the word.

#### **7. Education Curriculum Development:**

The major obstacle is getting approval from each university and the CSU Chancellors Office to add a new course into an existing curriculum. This process could take up to one year or more from date of submission (as different reviewing bodies need to sign-off on the request). During the interim; however, topics on hydrogen fueling station/fuel cells will be incorporated into existing classes, which I have listed below for each university as previously mentioned under Preliminary Course Offering.

- At CSULA under the Power, Energy and Transportation Program the following classes are possible candidates that the professor could add hydrogen fueling related topics:
  - a) Emerging Technologies: Fuel Cell Applications
  - b) Emerging Technologies: Wind and Solar Power
  - c) Electric, Hybrid and Alt. Fueled Vehicles
  - d) Electronic and Computer Control Systems

- e) Power Generation, Distribution and Utilization; and
- f) Fuel Cell Systems (graduate)
- g) Renewable Energy and Sustainability (includes topics of H<sub>2</sub> as fuel)
  - At CSUS, the following classes are considered as possible hydrogen interconnected topics:
    - a) Wind, Hydro, Ocean Energy and fuel cells
    - b) Thermodynamics
    - c) Fluid Mechanics
    - d) Heat Transfer
  - At CPSLO, the following classes are possible candidates to include hydrogen station/fuel cell related topics:
    - a) Energy Storage/Electrochemistry/Thermodynamics
    - b) Sustainable Electric Energy Conversion
    - c) Special Topic: Automotive Electronics and Electric Power
    - d) Solar Photovoltaic Systems Design
    - e) Thermodynamics
    - f) Fluid Mechanics
    - g) Heat Transfer
    - h) Mechanical Control Systems
    - i) Advanced Thermodynamics
    - j) Mechanical Systems Analysis
    - k) Electronic Image Sensors & Systems

Course framework consist as follows:

- Class instruction that discusses hydrogen physical properties and characteristics and the practical applications as an alternative fuel source;
- Discussion about Fuel Cell vehicles and the perspectives how this technology can alter our biosphere activity
- Discussion about the design requirements of a hydrogen station, with different examples reviewed.
- Equipment selection as to the type of hydrogen generator, will it be reformed or electrolyzer unit that supplies hydrogen
- Codes and standards that apply and how each cities jurisdiction interpret the codes differently
- Selection of construction site, building and piping material applicable for hydrogen to avoid potential hazards and leaks
- Business operation and maintenance requirements
- Community interface, to better educate the public about the use of hydrogen
- Classes for first responders and finally
- Encourage greater research that supports economic and technologies strategies to expand the hydrogen infrastructure

HyGen's review process will incorporate a multi-pronged approach for all of the hydrogen station projects and training programs at each university. Program implementation will include outreach through face-to-face meetings, webinars,

conference presentations, fact sheets, case studies, best practices, financial and feasibility models, traditional and new media outlets, and sharing best practices and lessons learned. Real-world experience is the goal—both actual and virtual— using the CSULA hydrogen station as a working laboratory with possible broadcast video segments that can be viewed by the other university partners.

Stakeholders valued honest communication and this will be imparted through these hands-on experiences and models, providing a realistic basis for recommending hydrogen and fuel cells without overselling the technology. Collaboration is necessary and should be comprehensive to encourage other universities and possibly state projects to serve as a model for other states to follow.

HyGen's workforce/education training program outlined above will be a model for reform at all levels of the education system in which engineering and technology classes are taught. HyGen's idea is to open a new doorway to include hydrogen and fuel cells as a major topic under the current educational/training framework and to help others in making this possible.

Sincerely,

---

Paul Staples, Chairman/CEO  
HyGen Industries  
707-667-5329 – Ph.  
P.O. Box 6911  
Eureka, Ca. 95502  
paulstapleshygen - Skype  
h24u@hygen.com  
www.hygen.com